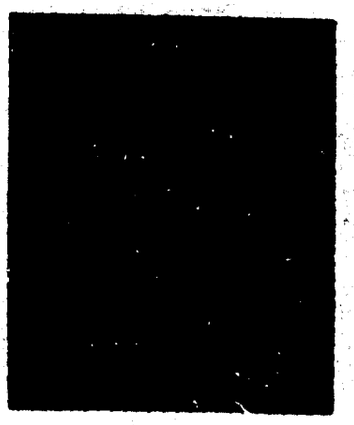

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Technical Report

AD 640 105

MECHANIZATION STUDY OF THE NONDESTRUCTIVE TESTING INFORMATION CENTER ARMY MATERIALS RESEARCH AGENCY, WATERTOWN, MASS.

Submitted to

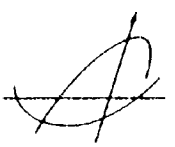
Defense Supply Agency
Defense Documentation Center
Cameron Station, Virginia
by

Booz, Allen Applied Research, Inc.
4733 Bethesda Avenue
Bethesda, Maryland 20014

Under Contract No. DSA-7-15489

BAARINC Report No. 914-1-8

September 1966



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ABSTRACT

The Nondestructive Testing Information Center uses the Termatrex system of coordinate indexing to identify and retrieve desired abstract cards and documents in their collection. The system uses visual coincidence ("peek-a-boo") term cards in which holes are drilled in specific locations to represent documents possessing a particular term. Documents identified by a group of desired terms may be retrieved by superimposing the term cards and observing the resulting coincident holes. The present set of cards is capable of handling up to 10,000 documents. Expansion beyond this capacity requires an additional deck of term cards that must be processed and searched separately. Since the Termatrex system is an economical, rapid retrieval system that fills the Center's needs, no plans have been made for the application of computer techniques.

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I. SUMMARY

The Nondestructive Testing Information Center uses the Termatrex system of coordinate indexing to identify and retrieve desired abstract cards and documents in their collection. The system uses visual coincidence "peek-a-boo" term cards in which holes are drilled in specific locations to represent documents possessing a particular term. Documents identified by a group of desired terms may be retrieved by superimposing the term cards and observing the resulting coincident holes. The present set of cards is capable of handling up to 10,000 documents, i.e., there are 10,000 hole positions on a term card. Expansion beyond this capacity requires an additional deck of term cards that must be processed and searched separately. Since the Termatrex system is a low cost, manually operated, rapid retrieval system that adequately fills the needs of the Center, it has not been found necessary to plan for the application of computer techniques at this time.

The Center was established in February 1961 (at what was then the Watertown Arsenal Laboratories) primarily to collect, maintain, and disseminate information in the field of nondestructive testing for the Ordnance Corps. In July 1964, the Information Center was officially designated a Center for Analysis of Scientific and Technical

Information as described in DoD Instruction 5100.45. Responsibility is assigned to the U. S. Army Materials Research Agency, Watertown, Massachusetts.

The Center's data base is currently made up of about 4,800 reports and abstracts. At present, this collection is growing at a rate of 1,000 items per year. In the past two years, the Center performed about 97 different literature searches as requested by 70 different governmental and commercial organizations in addition to requests from the local sources. Besides information searches, the Center also publishes a number of report guides (compilations of document abstracts in a particular subject area), information pamphlets, standard specifications and regulations of interest, and a newsletter of nondestructive testing information.

II. MECHANIZATION

1. CHRONOLOGY

In 1961 the Center began looking for a system that would permit it a means of rapidly extracting desired information from their collection of abstracts and reports. The conventional 3 x 5 card file system was eliminated as being bulky and inefficient. The edge-punched card system was also eliminated because only a limited number of index terms could be used in each report reference and because of the difficulty of searching by the needle-shake method once the file grew large. Utilization of the automatic data processing equipment within Watertown Arsenal was rejected because of the limited capacity (50 to 90 printing characters) of EAM cards. This limitation would preclude the incorporation of abstracts on the EAM cards and limit the number of index terms. In addition, the remote location of the EAM equipment from the Center would render it inaccessible on short notice.

As a result of a trip to DDC (at that time, ASTIA), the Center's staff became interested in the "peek-a-boo" card system of coordinate indexing and the commercial Termatrex equipment that uses this system. Termatrex Model T10-TKA with 1,300 term cards was purchased for $3,600 and received in the fall of 1961; it has been in continuous operation since.

2. MECHANIZED PROCESS DESCRIPTION

In the coordinate index system utilizing "peek-a-boo" cards, an index term from a thesaurus is printed on each card (Appendix A is a sample of the Center's thesaurus). Holes are then made in each card denoting by hole coordinates each document number that carries the index term. Later, the document number is retrieved using a coordinate grid overlay and reading the 100's position on the y-axis and the units position on the x-axis. There is space on the cards for 10,000 document reference holes. Retrieved document numbers may then be used to obtain abstract cards or documents from the Center's file. Appendix B illustrates a typical abstract card with coded descriptors from the thesaurus. Operation of the system from the standpoint of both the documents and the user is shown in Appendix C.

To search the system, the user selects cards corresponding to his desired index terms and superimposes them all together over a card-size light source. If a document contains all of the desired terms, its representative holes on the term cards will coincide permitting light to shine through. Coordinates of the lighted holes are the desired document numbers. The Center has quoted the following example of system operation.

"Assuming a search is to be made regarding information on ultrasonic testing of welds in missiles. Three descriptor cards are involved here, 'Ultrasonics,' 'Welds,' and 'Missiles.' The 'Ultrasonics' card contains all the information on ultrasonics in the System; 'Welds,' all the information on welds; and 'Missiles,' all information on missiles. By overlapping 'Ultrasonics' and 'Welds,' the light shines through only at those locations that identify documents yielding information on ultrasonic testing of welds. Everything else is excluded. By overlapping Missiles on top of the preceding two cards, all information on ultrasonic testing of welds for items other than missiles is excluded and light shines through only for those documents pertaining to ultrasonic testing of welds in missiles. The System is also quite flexible since ultrasonic testing of steel welds in missiles can be determined by simply overlapping the descriptor card of 'Steel'; or 'Ultrasonics' can be replaced by 'X-Ray' for a search in another direction."

Two or three minutes are said to represent a typical time for conducting a search.

The Termatrex equipment consists of a precision drill, a file of flexible plastic cards containing special identifying features such as number tabs and colors, and a light box for readout purposes.

Holes are made in the cards with the precision drill which is movable on two axes to the appropriate coordinates. Coordinates are determined by a 100 x 100 grid. Item number 1427, for example, would correspond to the 15th row and the 28th column. A microswitch must be closed on each of the axis and on the platen on which the card-holding template sets before the drill will operate. A warning device installed on the drill reduces errors resulting from out-of-sequence drilling. Color filters are used to indicate whether or not a complete document is in the Center's files and whether or not the document is classified. A green transparent card is drilled when the document is in the Center's files; left undrilled when not. Therefore, a green coincident term card hole indicate that only the document abstract is available; a white hole indicates that the document is available. A red transparent card is drilled when the document is unclassified and not drilled when classified. Therefore, a red coincident hole indicates a warning that the document is classified.

A method for searching all publications in the system authored by the same person has also been developed. This method uses one Termatrex card for each of the following categories:

1. first letter of the first name
2. first letter of the last name

3. second letter of the last name

4. third letter of the last name.

Cards for these categories for all authors in the system are segregated into four corresponding groups. The user makes his document selections in the same fashion as described for subject term, except that each search requires exactly four cards. Appendix D illustrates the distribution of cards in this arrangement.

The term cards are provided with color-coded tabs in one of six colors. In the past, the Center used these to simplify subject filing, e.g., black for "X-Ray"; blue for "Ultrasonics." However, because of the growth of the file and the need for spare cards, the color distinction has largely lost its significance. The term card thesaurus, shown in Appendix A, illustrates how the card tab color forms part of the card identification (B-black, O-orange, etc.).

Capacity of a complete Termatrex system is 10,000 document references corresponding to as many hole positions on each term card. In order to accommodate a larger number of references, as many card file systems are necessary as there are multiples of 10,000 references. Term cards belonging to a maximum of 10 different systems may be identified by a scheme of punching the edge of the card in a specified position. This, however, does not relieve the user of the necessity

of conducting separate searches in each system, viz., cards from one system cannot be intermingled with cards from another system for a common search. One and one-half man-years are annually expended in working with the equipment, not including the clerical labor in drilling the card holes.

Nondestructive Testing Information Analysis Center
U. S. Army Materials Research Agency
Watertown, Mass.

Descriptor List (as of 5 January 1966)

RADIOLOGY

Absorption
Automation
Autoradiography
Beta Radiation
Betatron
Bremsstrahlung
Calibration
Cesium ^{137}
Cobalt ^{60}
Collimation
Color Radiography
Disintegration, Decay
Electron Diffraction
Electron Microscopy
Equipment
Exposure Technique
Film Constrast
Film Definition
Film Density
Film Exposure
Film Process
Film Quality
Film Radiography
Film Sensitivity
Film Viewing, Interpretation
Fluoroscopy
Focal Spot
Gamma Radiation
Half Value Layer
High Speed Radiography
High Voltage (Above 1 MEV)
In-Motion Testing, Radiography
Image Intensification
Iridium ^{192}
Linear Absorption
Linear Accelerators
Low Voltage (Below 50 KV)
Medium Voltage (50 KV to 1 MEV)
Microradiography
Monitoring and Surveying
Neutron; Radiography, Activation, etc.
Pair Production
Particle Accelerators
Penetrameters
Photoconductors
Photoelectric
Pulsed X-Ray
Radiation Damage, Irradiation
Radiation Detection, Detectors
Radiation Intensity
Radiation Shielding, Protection
Radiographic Paper
Radium
Reference Radiographs
Resonant Transformer
Safety
Scatter, Backscatter
Screens, Intensifying, Fluorescent
Screens, Intensifying, Nonfluorescent
Solid Core Transformer
Specifications
Standards, Calibration
Stereoradiography
Television, Remote Viewing
Thorium
Thulium ^{170}
Tracers
Xeroradiography
X-Radiation
X-Ray Diffraction
X-Ray Fluorescent Analysis
X-Ray Microscopy
X-Ray Spectroscopy, Compton Effect
X-Ray Sources
X-Ray Tubes, Components
X-Ray Tubes, Design, General
Magnification (Excluding Optical)

ULTRASONICS

A, B, and C Scan
Acoustic Emission
Attenuation
Beam Divergence/Profile

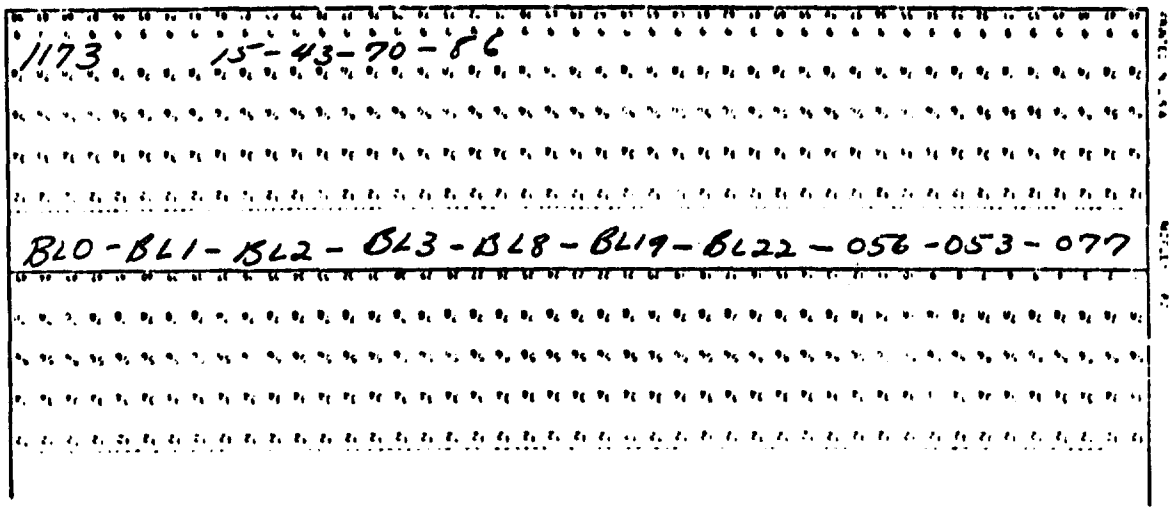
BONDING METHODS AND A BONDING CLAMP FOR ULTRASONIC MEASUREMENTS

1173 P.F. Sullivan

WAL TN 143/40, Watertown Arsenal Laboratories, Watertown, Mass., Dec 61; also J. Acoust Soc. Am. Vol 34, No. 12, Dec 62

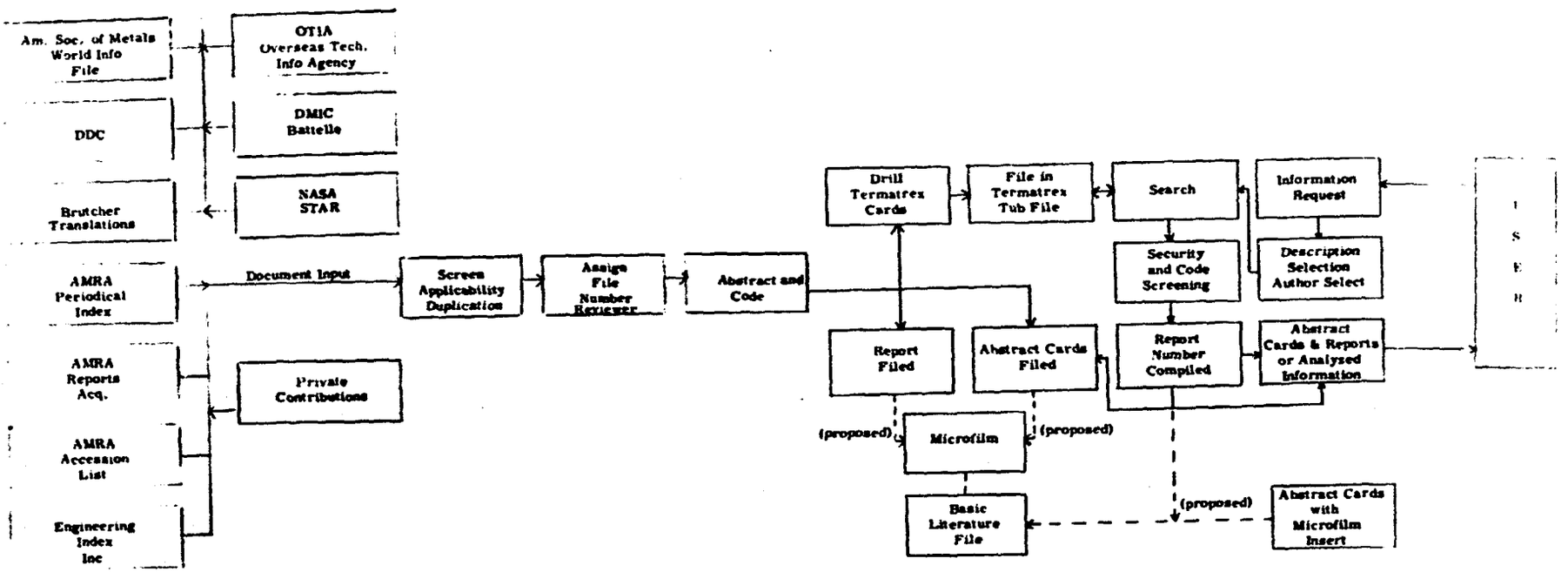
The results of an investigation conducted to improve bonding techniques between the transducer and specimen in ultrasonic measurements are presented. Two major coupling agent , glycerin and phenyl salicylate, were subjected to tests. As a result of these tests, a bonding clamp was developed which greatly increased the reproducibility and accuracy of measurements. (In WAL TN only: A new bonding method using glycerin and oil is reported.)

Front of Card Showing Abstract



Rear of Card Showing Descriptors

BAARING


Am. Soc. of Metals World Info File
OTIA Overseas Tech. Info Agency
DDC
DMIC Battelle
Brutcher Translations
NASA STAR
AMRA Periodical Index
Document Input
Screen Applicability Duplication
Assign File Number Reviewer
Abstract and Code
AMRA Reports Acq.
Private Contributions
AMRA Accession List
Engineering Index Inc
Drill Termatrex Cards
File in Termatrex Tub File
Search
Information Request
Security and Code Screening
Description Selection Author Select
Report Filed
Abstract Cards Filed
Report Number Compiled
Abstract Cards & Reports or Analysed Information
(proposed)
Microfilm
(proposed)
(proposed)
Basic Literature File
Abstract Cards with Microfilm Insert
U S E R

Author Cards - White

1st Letter First Name	1st Letter Last Name		2nd Letter Last Name	3rd Letter Last Name
0	25	A	50	75
1	26	B	51	76
2	27	C	52	77
3	28	D	53	78
4	29	E	54	79
5	30	F	55	80
6	31	G	56	81
7	32	H	57	82
8	33	I	58	83
9	34	J	59	84
10	35	K	60	85
11	36	L	61	86
12	37	M	62	87
13	38	N	63	88
14	39	O	64	89
15	40	P	65	90
16	41	Q	66	91
17	42	R	67	92
18	43	S	68	93
19	44	T	69	94
20	45	U	70	95
21	46	V	71	96
22	47	W	72	97
23	48	XZ	73	98
24	49	Y	74	99

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is)

BOOZ ALLEN APPLIED RESEARCH, INC. 4733 Bethesda Avenue Bethesda, Maryland 20014	Unclassified

REPORT TITLE

Mechanization Study of the Nondestructive Testing Information Center, Army Materials Research Agency, Watertown, Mass.

DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Report of on-site survey

AUTHOR(S) (Last name, first name, initial)

G. A. Kershaw, D. Crowder, J. E. Davis, E. G. Loges, E. Merendini, S. M. Thomas

REPORT DATE	TOTAL NO. OF PAGES	NO. OF REFS
September, 1966	20	0

CONTRACT OR GRANT NO.	ORIGINATOR'S REPORT NUMBER(S)
DSA-7-15489	914-1-8
PROJECT NO.	OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
	AD 640 105

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DD FORM 1473

Unclassified

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Information Retrieval						
Data						

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